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Article

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Abstract

Background
Rising obesity rates and declining fitness levels have increased interest in understanding what underlies these trends. This article presents the first directly measured data on physical activity and sedentary behaviour on a nationally representative sample of Canadians aged 20 to 79 years.

Data and methods
Data are from the 2007 to 2009 Canadian Health Measures Survey (CHMS). Physical activity was measured using accelerometry. Data are presented as time spent in sedentary, light, moderate and vigorous intensity movement as well as steps accumulated per day.

Results
An estimated 15% of Canadian adults accumulate 150 minutes of moderate-to-vigorous physical activity (MVPA) per week, 5% accumulate 150 minutes per week as at least 30 minutes of MVPA on 5 or more days a week. Men are more active than women and MVPA declines with increasing age and adiposity. Canadian adults are sedentary for approximately 9.5 hours per day (69% of waking hours). Men accumulate an average of 9,500 steps per day and women, 8,400 steps per day. The 10,000-steps-per-day target is achieved by 35% of adults.

Interpretation
Before the CHMS, objective measures of physical activity and sedentary behaviour were not available for a representative sample of Canadians. The findings indicate that 85% of adults are not active enough to meet Canada's new physical activity recommendation.

Keywords
Actical, exercise health measurement, motor activity, pedometer, physical fitness, public health, obesity, sedentary behaviour

Authors
Rachel C. Colley (613-737-7600 ext 4118; rcolley@cheo.on.ca) is with the Children's Hospital of Eastern Ontario Research Institute and the Health Analysis Division at Statistics Canada. Didier Garriguet (613-951-7187; Didier.Garriguet@statcan.gc.ca) is with the Health Analysis Division and Janine Clarke is with the Physical Health Measures Division at Statistics Canada. Ian Janssen is with Queen's University. Cora L. Craig is with the Canadian Fitness and Lifestyle Research Institute. Mark Tremblay is with the Children's Hospital of Eastern Ontario Research Institute and the University of Ottawa.

Regular physical activity is associated with a reduced risk of cardiovascular disease, some types of cancer, osteoporosis, diabetes, obesity, high blood pressure, depression, stress and anxiety.[1-5] As well, strong evidence suggests that higher levels of physical activity are associated with health benefits; in fact, the more activity, the greater the health benefit.[1-5] To determine whether Canadians are sufficiently active to obtain health benefits, the 2007 to 2009 Canadian Health Measures Survey (CHMS) used accelerometers to collect the first time-sequenced objective measures of physical activity for a nationally representative sample of 6- to 79-year-olds.

Before the CHMS, national trends in physical activity were derived from self-report surveys, the results of which suggested that the percentage of adults who perceive that they are active has been increasing.[6-8] In 2009, 52.5% of Canadian adults reported that they were at least moderately active during their leisure time.[6] Yet the prevalence of obesity has risen considerably in Canada over the past 25 years,[9] with a quarter of adults now overweight or obese.[10] Moreover, muscular strength and flexibility, typically maintained by regular physical activity, have declined since 1981.[10] If half of Canadians are, indeed, sufficiently active for health benefit, it is unlikely that such trends in obesity and fitness would be observed. These counterintuitive findings have increased interest in supplementing self-reported physical activity data with information from devices such as pedometers and accelerometers.

Canada is one of several countries that have recently, or are currently, revising their physical activity recommendations.[5,11,12] Efforts have been made to harmonize the revision and recommendation processes among

countries (for example, Canada, United States, United Kingdom, Australia), as well as with the World Health Organization (WHO).[13,14] This has led to a recommendation that adults should engage in at least 150 minutes per week of moderate-to-vigorous physical activity (MVPA), accumulated in bouts lasting at least 10 minutes.[5,11-14] The 150 minutes can be accumulated in a variety of ways (for example 30 minutes, 5 days a week). Accelerometry data from the CHMS allow for an objective assessment of how many Canadians are meeting this recommendation.

Health promotion efforts have historically focused on encouraging leisure-time physical activity (LTPA) of at least moderate intensity. But LTPA represents only a small fraction of total daily movement, and attention is being directed toward the roles of sedentary behaviour and incidental movement in obesity and health.[15-17] Time spent in sedentary pursuits is now recognized as not simply the absence of physical activity, but rather, a distinct set of behaviours with unique health effects independent of those associated with a lack of LTPA.[18-23] The use of accelerometers in the CHMS makes it possible to quantify time spent at various movement intensities, including sedentary levels.

In partnership with the Public Health Agency of Canada and Health Canada, Statistics Canada launched the CHMS in 2007. After a household interview, respondents went to a mobile examination centre where they underwent a series of direct health measures and received an accelerometer to wear for one week. This paper describes levels of measured physical activity in Canadian adults by age, sex and body weight status. Adherence to the new physical activity recommendations is also assessed.

Methods

Data source

The Canadian Health Measures Survey (CHMS),[24-27] is a nationally representative survey that covers the Canadian population aged 6 to 79 years living in private households at the time of the survey. Residents of Indian Reserves or Crown lands, institutions and certain remote regions, and full-time members of the Canadian Forces are excluded. Approximately 96% of Canadians are represented.

Ethics approval to conduct the survey was obtained from Health Canada's Research Ethics Board.[25] All respondents provided informed written consent. Participation was voluntary; respondents could opt out of any part of the survey at any time. Data were collected at 15 sites across Canada from March 2007 through February 2009.

The response rate for the selected households was 69.6%, meaning that a resident in 69.6% of the households provided the sex and date of birth of all household members. In each responding household, one or two members were chosen to participate in the CHMS; 88.0% of selected 20- to 79-year-olds completed the household questionnaire, and 83.1% of this group participated in the mobile examination centre component of the survey. Of the adults aged 20 to 79 years for whom an activity monitor was available, 91.7% had at least 1 valid day of data, and 82.9% had at least 4 valid days. After adjustments to account for the sampling strategy,[26] the final response rate for having at least 4 valid days was 42.2% (69.6% x 88.0% x 83.1% x 82.9%).

This article is based on 2,832 examination centre respondents aged 20 to 79 years who wore the monitor for at least 4 days (Table 1). Of those who accepted the accelerometer and returned it, 96.2% had at least 1 valid day of data, and 87.0% had at least 4 valid days (Table 2). The mean daily accelerometer wear time for all valid days was 14.0 hours. Older people aged 60 to 79 years had less daily wear time (13.5 hours) than did 20- to 39-year-olds (14.1 hours) (data not shown).

Physical activity outcomes are presented by body weight status. Adults were classified using published BMI ranges[28,29]: healthy weight (18.5 to 25.0 $kg \cdot m^{-2}$), overweight (25.0 to 29.9 $kg \cdot m^{-2}$), or obese (30.0 $kg \cdot m^{-2}$ or more).

Measurement procedures

Upon completion of their mobile examination centre visit, ambulatory respondents were asked to wear an Actical accelerometer (Phillips – Respironics, Oregon, USA) over their right hip on an elasticized belt during their waking hours for 7 days. The monitors were initialized to start collecting data at the first occurrence of midnight after the mobile examination centre appointment.

Table 1
Selected characteristics of weighted sample, by age group and sex, household population aged 20 to 79 years, Canada, March 2007 to February 2009

	Age group (years)					
	20 to 39		40 to 59		60 to 79	
Characteristic	Men	Women	Men	Women	Men	Women
Total sample (number)	**395**	**509**	**480**	**547**	**452**	**449**
Age (years)	30.0	30.0	48.3	49.5	67.3	67.2
Height (cm)	176.6	163.8	175.5	162.6	172.6	159.5
Weight (kg)	82.7	69.1	86.3	70.3	84.1	70.9
BMI (kg/m^2)†	26.5	25.8	28.0	26.6	28.2	27.9
BMI category (%)†						
Healthy weight	39.8	51.4	21.1	47.2	25.3	32.5
Overweight	40.7	24.2	56.0	30.7	43.4	38.8
Obese	18.4‡	19.5	22.6‡	21.6	31.0	28.3

† excludes pregnant women
‡ use with caution
Source: 2007 to 2009 Canadian Health Measures Survey

Table 2
Unweighted distribution of respondents, by valid days of accelerometer wear (10 or more wear hours), age group and sex, household population aged 20 to 79 years, Canada, March 2007 to February 2009

Age group (years)/ Sex	Number of valid days of accelerometer wear									
	0†	1	2	3	4	5	6	7	1 or more	4 or more
	% of respondents									
Total	**3.8**	**2.6**	**2.7**	**3.9**	**5.6**	**12.0**	**21.0**	**48.4**	**96.2**	**87.0**
20 to 39										
Men	5.0	3.7	2.3	7.4	9.1	15.1	19.6	37.8	95.0	81.6
Women	4.8	3.7	3.7	3.3	6.0	11.0	21.8	45.8	95.2	84.6
40 to 59										
Men	2.8	2.0	2.4	3.4	5.0	11.4	23.6	49.3	97.2	89.4
Women	3.4	1.5	2.8	3.1	4.1	9.0	22.2	54.0	96.6	89.2
60 to 79										
Men	2.6	2.4	2.6	3.2	3.8	15.6	19.8	50.2	97.4	89.3
Women	4.1	2.3	2.3	3.7	5.8	11.3	18.3	52.0	95.9	87.5

† agreed to wear accelerometer, but returned device with no valid data
Source: 2007 to 2009 Canadian Health Measures Survey

The monitors were returned in a prepaid envelope to Statistics Canada, where the data were downloaded and the monitor was checked to determine if it was still within the manufacturer's calibration specifications.[30]

The Actical (dimensions: 2.8 x 2.7 x 1.0 centimetres; weight: 17 grams) measures and records time-stamped acceleration in all directions, thereby indicating the intensity of physical activity. The digitized values are summed over a user-specified interval of 1 minute, resulting in a count value per minute (cpm). Accelerometer signals are also translated into steps accumulated per minute. The Actical has been validated to measure physical activity in adults[31] and children[32,33] and step counts in adults and children.[34] All data are blind to respondents while they are wearing the device.

Biologically implausible data were assessed to determine if files should be included in final analyses; the procedures applied to manage such data are described elsewhere.[30] Published guidelines were followed to identify and remove days with incomplete (invalid) accelerometer wear time.[30,38,39] A valid day was defined as 10 or more hours of wear time; respondents with 4 or more valid days were retained for analyses.[38] Wear time was defined by subtracting nonwear time from 24 hours. Nonwear time was defined as at least 60 consecutive minutes of zero counts, with allowance for 1 to 2 minutes of counts between 0 and 100.

Time spent in various levels of movement intensity—sedentary, light, moderate, vigorous—is based on the application of intensity cut-points corresponding to each intensity level (Table 3).

Adherence to various physical activity targets was examined:

1. New Canadian and Global WHO recommendation: 150 minutes of MVPA per week accumulated in 10-minute bouts. To count as a bout, 10 consecutive minutes of observations had to exceed the moderate intensity cut-point, with allowance for a maximum of two observations falling below the cut-point during that period (8 out of 10 minutes had to be above the cut-point).[5,12-14]
   a) Adherence defined as a weekly sum of 150 or more minutes of MVPA per week. If respondents had 4 to 6 valid days, their average daily MVPA was multiplied by 7 to obtain a weekly sum.
   b) Adherence defined as the probability of accumulating at least 30 minutes of MVPA on at least 5 days of the week.
2. 10,000 steps per day.[40-42]

To determine the probability that adults accumulate at least 30 minutes (or 15 minutes) of MVPA on at least 5 days per week, the analytical approach was harmonized with that used in the analysis of the 2003-2004 NHANES accelerometry data.[38] To maximize the sample size (important because only 48.4% of the sample aged 20 to 79 years who wore accelerometers had 7 valid days of wear), a Bayesian approach was used to incorporate the information from all respondents with 4 or more valid days. An individual's probability of being adherent (active at least 5 out of 7 days) was estimated using a Beta distribution for its observed combination

Table 3
Physical activity intensity cut-points for Actical accelerometer[35-37]

Intensity	Metabolic Equivalent (METS)	Example	Accelerometer count range (counts per minute)
Sedentary	1 to less than 2	Car travel, sitting, reclining, standing	Less than 100*
Light	2 to less than 3	Walking less than 3.2 km/h, light household cleaning, cooking	100 to less than 1,535
Moderate	3 to less than 6	Walking more than 3.2 km/h, cleaning (vacuuming, washing car), bicycling for pleasure	1,535 to less than 3,962
Vigorous	6 or more	Jogging, competitive team sport participation	3,962 or more

* including wear-time zeros

of active and wear days. The estimated population prevalence of adherence is the weighted average of these individual probabilities. Further detail is available elsewhere (http://riskfactor.cancer.gov/tools/nhanes_pam).[39]

Compared with other accelerometer models, the Actical has better instrument reliability,[43] and its omni-directional capability allows it to capture a wider range of movement than a uni-axial device such as the Actigraph used in NHANES. The Actical is also waterproof, which may have helped with compliance as respondents did not have to remove the device so often throughout the day.

Statistical analysis

All analyses were conducted with SAS Version 9.1 and were based on weighted data using respondents with 4 or more valid days. To account for the survey design of the CHMS, standard errors, coefficients of variation and 95% confidence intervals were estimated with the bootstrap technique.[44] Comparisons of physical activity among age and sex groupings were made with pairwise contrasts. Differences between estimates were tested for statistical significance, which was established at $p < 0.05$.

Results

Age, sex and BMI

The majority of Canadian adults' waking hours—68% for men and 69% for women—are sedentary. Total average daily sedentary time is 575 minutes (9.6 hours) for men and 585 minutes (9.8 hours) for women (Table 4). Overall, men and women engage in about 4 hours per day of light physical activity.

At ages 20 to 39, men accumulate more MVPA than do women: 33 versus 24 minutes per day; a sex difference is not evident at ages 40 to 79 years. Healthy weight men average 35 minutes a day of MVPA, while overweight and obese men average significantly less: 26 and 19 minutes, respectively. Healthy weight women accumulate an average of 25 minutes of MVPA a day, while overweight women accumulated 20 minutes, and obese women, 13 minutes.

Table 4
Average daily minutes of activity at various levels of intensity and average daily step counts, by sex, age group and BMI category, household population aged 20 to 79 years, Canada, March 2007 to February 2009

Sex /Age group/ BMI category	Intensity of activity					Step counts
	Sedentary	Light	Moderate	Vigorous	Moderate-to-vigorous (MVPA)	
	Minutes per day					Average
Men	**575**	**246**	**24***	**3**	**27***	**9,544***
Age group (years)						
20 to 39†	571	253	28*	5	33*	9,926
40 to 59	570	258	24	3‡	26	9,996*
60 to 79	594‡	208‡	15‡	2‡§	17‡	7,869‡
BMI category						
Healthy weight†	575	252	29*	5	35*	10,577*
Overweight	570	251	23*‡	3‡§	26*‡	9,491*
Obese	586	230	17*‡	2‡§	19*‡	8,342‡
Women	**585**	**238**	**18**	**3**	**21**	**8,385**
Age group (years)						
20 to 39†	572	249	20	4‡	24	8,875
40 to 59	588	245	19	3	21	8,677
60 to 79	602‡	205‡	12‡	1‡§	12‡	6,970‡
BMI category						
Healthy weight†	589	234	21	4	25	8,819
Overweight	583	242	18	2‡	20	8,506
Obese	583	243	12‡	<2‡	13‡	7,546‡

† reference category
* significantly different from estimate for women ($p<0.05$)
‡ significantly different from estimate for reference category ($p<0.05$)
§ use with caution
Source: 2007 to 2009 Canadian Health Measures Survey.

Meeting recommendations

According to the CHMS data, 15% of adults (17% of men and 14% of women) accumulate 150 minutes per week of MVPA in 10-minute bouts (Table 5). The percentage of adults accumulating 150 minutes on a regular basis—at least 30 minutes on at least 5 days a week—is 5%. Overall, about half (53%) are accumulating at least 30 minutes of MVPA 1 or more days per week, but almost as many (47%) do so less than one day a week (Table 6).

Step counts

Men average 9,500 steps per day, and women, 8,400 (Table 4). The daily average is significantly lower at ages 60 to 79 years: 7,900 steps for men and 7,000 steps for women. A significant sex difference is evident only in the 40-to-59-year age group (10,000 versus 8,700 steps per day). Obese men and women accumulate significantly fewer steps per day than do healthy weight adults. Just over a third (35%) of adults accumulate an average of 10,000 steps per day; older adults are significantly less likely than 20- to 39-year-olds to do so (Table 5).

Discussion

This article provides an overview of the physical activity levels of Canadians aged 20 to 79 years, based on the first objectively measured physical activity data collected for a representative sample of Canadians. The most important finding is that 15% of adults are meeting the revised physical activity recommendation. The majority—69%—of Canadian adults' waking hours are spent in sedentary pursuits.

Table 5
Percentage attaining selected physical activity criteria, by age group and sex, household population aged 20 to 79 years, Canada, March 2007 to February 2009

	Total			Men			Women		
		95% confidence interval			95% confidence interval			95% confidence interval	
Criterion/ Age group (years)	%	from	to	%	from	to	%	from	to
At least 30 minutes of moderate-to-vigorous physical activity, accumulated in bouts of at least 10 minutes, on at least 5 out of 7 days									
Total	**4.8**	**3.2**	**6.3**	**5.5**	**3.6**	**7.5**	**4.0**[E]	**2.5**	**5.5**
20 to 39[†]	4.5[E]	2.6	6.4	5.7[E]	3.3	8.2	3.3[E]	1.4	5.2
40 to 59	5.1[‡]	2.9	7.3	5.5[E]	2.4	8.5	4.7[‡]	2.6	6.8
60 to 79	4.5	3.1	6.0	5.3[E]	2.2	8.4	3.8[E]	2.0	5.6
More than 150 minutes a week of moderate-to-vigorous physical activity accumulated in bouts of at least 10 minutes									
Total	**15.4**	**10.9**	**19.8**	**17.1**	**11.3**	**23.0**	**13.7**	**10.1**	**17.3**
20 to 39[†]	17.4	11.2	23.7	21.1[E]	11.7	30.4	13.8[E]	7.8	19.8
40 to 59	14.6	9.4	19.8	15.1[E]	7.9	22.3	14.1	9.1	19.1
60 to 79	13.1	9.0	17.3	13.7[E]	8.1	19.3	12.6	8.3	16.9
Average more than 10,000 steps a day									
Total	**34.5**	**30.5**	**38.4**	**39.0***	**33.0**	**45.0**	**30.0**	**25.4**	**34.6**
20 to 39[†]	36.2	29.2	43.2	38.3	28.8	47.9	34.0	22.8	45.3
40 to 59	40.0	34.0	45.9	46.9*	36.8	56.9	33.1	27.8	38.5
60 to 79	20.3[‡]	14.0	26.7	24.1[‡]	16.5	31.7	17.0[‡E]	10.7	23.2

[†] reference category
* significantly different from estimate for women ($p<0.05$)
[‡] significantly different from estimate for reference category ($p<0.05$)
[E] use with caution
Source: 2007 to 2009 Canadian Health Measures Survey

Table 6
Percentage attaining selected physical activity criteria, household population aged 20 to 79 years, Canada, March 2007 to February 2009

	Moderate-to-vigorous physical activity accumulated in bouts of at least 10 minutes					
	At least 15 minutes a day			At least 30 minutes a day		
		95% confidence interval			95% confidence interval	
Days active out of 7	%	from	to	%	from	to
Less than 1	36.7	31.5	41.8	46.6	42.7	50.5
At least 1	63.3	58.2	68.5	53.4	49.5	57.3
At least 2	41.2	35.3	47.1	29.6	25.3	33.9
At least 3	26.5	21.5	31.5	16.8	13.3	20.3
At least 4	16.2	12.5	19.8	9.4	6.9	11.9
At least 5	8.8	6.3	11.3	4.8	3.2	6.3

Source: 2007 to 2009 Canadian Health Measures Survey

To obtain substantial health benefits, new WHO and Canadian guidelines[5,12,13] recommend that adults should accumulate at least 150 minutes of MVPA a week, a level achieved by 17% of men and 14% of women, according to the CHMS data. A considerable amount of the evidence in support of the 150-minutes-per-week recommendation suggests that frequent physical activity is important for health (that is, the 150 minutes should be spread across several days).[5] The percentage of Canadian adults reaching the 150-minutes-per-week recommendation by accumulating at least 30 minutes of MVPA on at least 5 days per week is about 5%.

CHMS data may provide insight into how the physical activity recommendations could be translated into practical messages. While the finding that 5% of Canadian adults accumulate 30 minutes of MVPA on 5 days per week is informative, further insight can be obtained by examining how close the remaining 95% come to this recommendation. Many adults are getting *some* physical activity, as 63% accumulate 15 minutes of MVPA at least *one* day a week. However, this means that more than a third (37%) do not reach even this modest level of activity. These findings provide targets for intervention and suggest a need to encourage a substantial share of Canadian adults to increase both the duration and frequency of their MVPA.

Objectively measured physical activity data from the 2005-2006 National Health and Nutrition Examination Survey (NHANES)[45] show that 3% of Americans aged 20 to 59 years were accumulating at least 30 minutes of MVPA in 10-minute bouts on 5 out of 7 days. CHMS data for the same age range show that the estimated prevalence is slightly higher in Canadian men (20 to 59 years: 6%), similar in Canadian women aged 20 to 39 years (3%), and higher in Canadian women aged 40 to 59 years (5%). The United States and Canada are both struggling with disturbing trends in obesity and chronic disease. Harmonization in health surveillance between countries

What is already known on this subject?

- Over the past 25 years, the prevalence of obesity has increased among Canadian adults.
- According to self-report estimates, 52.5% of Canadian adults are physically active.
- Moderate-to-vigorous physical activity (MVPA) is associated with health benefits.
- Sedentary behaviour is emerging as a negative contributor to health.

What does this study add?

- An estimated 15.4% of Canadian adults accumulate 150 or more minutes of moderate-to-vigorous MVPA in 10-minute bouts per week, and 4.8% do so at least 30 minutes on at least 5 days.
- A third of Canadian adults accumulate an average of 10,000 or more steps per day.
- On average, men accumulate 27 minutes a day of MVPA, and women, 21 minutes.
- Regardless of age group, men engage in more MVPA than do women.
- Men and women spend about 9.5 of their waking hours being sedentary.

may increase the efficiency with which efforts to encourage physical activity can be evaluated and implemented.

The CHMS finding that 15% of adults are meeting the 150 minutes of MVPA per week recommendation differs markedly from self-reported data. According to the Canadian Community Health Survey, more than half of adults are at least "moderately active" in their leisure time.[1,6,7] As population surveillance efforts such as the CHMS implement objective measures of physical activity, expected and substantive differences between self-reported and objective measures need to be examined and understood. Self-reported data are subject to bias,[46-49] typically resulting from social desirability and recall difficulties. Accelerometers are limited by their inability to capture some types of movement (for example, upper body, swimming), potential bias via the application of walking-based intensity cut-points, and the lack of contextual information about how physical activity is accumulated. Population surveillance that exploits the unique advantages of each methodology is desirable.

The CHMS data show that roughly a third of Canadian men and women achieved the well-known pedometer target of 10,000 steps per day. The average man takes approximately 9,500 steps per day, and the average woman, 8,400 steps. These figures are close to results of the 2005-2006 NHANES, which found that American adults averaged about 9,700 steps per day.[50] Collecting and reporting data from the pedometer function of the Actical offers some distinct advantages. Pedometers are now widely available and relatively economical for individuals to purchase. Furthermore, pedometer results are conceptually easier to understand than counts per minute data, and therefore, might lend themselves more easily to use in a variety of health and fitness settings.

"Sedentary" is increasingly being defined as a distinct subset of activities, rather than simply a lack of volitional physical activity of moderate or vigorous intensity.[23] Sedentary behaviour encompasses a broad range of activities (for instance, occupational sitting, TV watching, eating) that occur intermittently throughout the day.[17] According to the CHMS data, the majority (69%) of Canadian adults' accelerometer wear time was sedentary. This is higher than values observed in American analyses of the 2003-2004[51] and 2005-2006 NHANES,[15] which reported ranges of 50% to 60% of the day being spent in sedentary activities. With the sedentary end of the movement spectrum accounting for such a large share of a Canadian adult's day,[15] ongoing monitoring of this behaviour is needed. The CHMS sedentary time data constitute an objective baseline against which changes resulting from interventions and policy initiatives can be tracked and assessed.

Limitations

Accelerometers have several important limitations, notably, potential underestimation of overall activity because they cannot accurately capture activities that are not step-based (for example, swimming, cycling). In addition, accelerometers do not measure the added energy expenditure associated with upper body movement (for example, weight-lifting, shoveling snow), load carrying, or walking up an incline. However, walking is far more common than swimming, cycling, and weight training among Canadian adults.[52]

Current understanding of the appropriate amount of physical activity required to obtain health benefit is based on epidemiological evidence from self-report surveys. The gap between self-reported LTPA and accelerometer-measured MVPA is poorly understood and is an important area of future research. For example, a survey respondent who reports participation in a 60-minute hockey game may accumulate only 20 to 30 minutes of MVPA on the accelerometer. To transform raw accelerometry data into usable information, intensity cut-points must be applied to separate the activity data into sedentary, light, moderate and vigorous. Because of the paucity of published literature available to set adult cut-points for the Actical, the cut-points used in the present analysis were based on a small number of studies.[36,37]

The overall response rate to the accelerometry component of CHMS was 42.2%. Although adjustments were made to the sampling weights to compensate, estimates could be biased by systematic differences between respondents and non-respondents. For example, given that non-respondents tended to be younger, male, and more obese than

people who wore the accelerometer for 4 or more days, these individuals might be less active. Thus, the physical activity data in this analysis could be slightly overestimated.

Conclusions

The CHMS accelerometry data indicate that Canadians are less active than self-reported estimates suggest. In light of this new measurement capability, relationships between physical activity and health will need to be re-examined. The broad range of health outcomes assessed in the CHMS will allow researchers to study the impact physical activity and sedentary behaviour on health more objectively than has ever been possible. Exploration of these relationships is needed to inform the design, delivery and priority of healthy active living initiatives. Ongoing collection of physical activity measures will also allow for assessments of the efficacy of health interventions. ■

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